

Mathematical Modeling And Experimental Validation Of A Semi-Active Omnidirectional Tuned Liquid Column Damper

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This study presents a semi-active omnidirectional TLCD (O-TLCD) layout to realize adaptive and multidirectional vibration control. Where classical TLCDs encompass two L-arms connected at a center, the O-TLCD is formed when at least three of such L-arms are radially distributed around the center. Consequently, the O-TLCD reinforces structures with full counteracting force capacity in all transversal directions. The natural frequency of the O-TLCD can be adjusted by controlling the column cross-sectional areas. To be able to consider this effect in design, the mathematical model of the O-TLCD is developed using Lagrange's principle, where the role of the columns is scrutinized. Numerical simulations are conducted with a structure experiencing natural frequency variations. The influence of the column areas is investigated experimentally. Compared with uncontrolled and passively controlled cases, results demonstrate that the O-TLCD improves vibration control significantly.